REMARKS/ARGUMENTS

Reconsideration and continued examination of the above-identified application are respectfully requested.

The amendment to the claims is editorial in nature and/or further defines what the applicants regard as their invention. The applicants note that in the Office Action dated January 29, 2003, the Examiner indicated that claims 32-34 and 37-39 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 32 as amended, now incorporates the limitations of claims 1 and 8 as pending at the time of this earlier Office Action. Therefore, claim 32 is in condition for allowance. Claim 33 is now dependent on claim 40, which is allowed. Therefore, claim 33 is in condition for allowance. Furthermore, claim 31 incorporates the limitations of claim 1, which places claim 31 in condition for allowance, since the Examiner has only objected to claim 31 and has indicated that claim 31 would be allowable. Claims 37-39 are directly or indirectly dependent on claims 32, 33, and 31, respectively. Accordingly, claims 37-39 are in condition for allowance. Additionally, claim 30 further defines the toner particles of the present application. Full support for the amendment can be found in claims as originally filed, for instance, at claims 1, 5, 7, 8, and 11-15, as well as throughout the specification, for instance, at pages 9, 12, 22, and 25. Therefore, no new questions of patentability should arise nor does the amendment necessitate any further searching on the part of the Examiner since the Examiner has essentially considered similar subject matter in the previously examined claims 1, 5, 7, 8, and 11-15. Further, the amendment places the application in condition for allowance. At a minimum, the amendment places the application in a better condition for appeal. Accordingly, no questions of new matter should arise and entry of the

amendment is respectfully requested.

Claims 2, 4-7, 9-11, 13-20, 22-33, and 35-41 are pending in the application. Claims 1, 3, 8, 12, 21, 34, 42, and 43 have been cancelled, and claims 40 and 41 have been allowed.

At page 3 of the Office Action, the Examiner rejects claims 3, 4, 8, 9, 11-15, 17, 18, 20-29, 32-34, and 37-39 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicants regard as the invention.

The Examiner asserts that claims 3, 4, 8, and 11 are indefinite because the phrase "inorganic particles comprise silica" is redundant and does not further limit claim 1.

The Examiner also asserts that claims 12 and 14 are indefinite because the phrase "said inorganic particles comprise from about ... wt% to about ... wt% silica" lacks proper antecedent basis in claim 1. Additionally, the Examiner asserts that claim 33 is indefinite because the phrase "wherein the toner particles having a charge rate such that the 2'/10' MECCA charge ratio is from about 0.9 to 1.1" is redundant and does not further limit claim 41. For the following reasons, this rejection is respectfully traversed.

To further expedite the prosecution of the present application, the applicants have cancelled claims 3, 8, 12, 21, and 34. Additionally, claims 4, 11, and 14 now incorporate the Examiner's recommendations and are now dependent directly on claim 31, which is now in condition for allowance. As stated above, claim 32 now incorporates the limitations of claims 8 and 1 to place claim 32 is in condition for allowance. Accordingly, the rejection under 35 U.S.C. §112, second paragraph, should be withdrawn.

The Examiner also objects to claim 1. The Examiner asserts that to avoid any ambiguity of antecedent basis, the phrase "based on the weight of the toner" should be

rewritten as "based on the weight of the toner particles." For the following reasons, this objection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claim 1 has been cancelled. Accordingly, the objection to claim 1 is moot. However, the Examiner's comments have been taken into account with respect to claim 31.

At page 5 of the Office Action, the Examiner rejects claims 30 and 35 under 35 U.S.C. §102(e) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Watanabe et al. (U.S. Patent No. 6,074,795). The Examiner refers to the Office Action dated January 29, 2003 to support her rejection of claims 30 and 35. The Examiner further states that although the applicants provided a copy of the Nash article "Toner Charge Instability," the applicants failed to provide the source and publishing date of the article. The Examiner also states that if the applicants provide the necessary information regarding the Nash article, the Examiner will withdraw the rejection. For the following reasons, this rejection is respectfully traversed.

In order to comply with the Examiner's request, the applicants enclose the title page, page ii, and page 169 of Nash, which include the information requested by the Examiner. Furthermore, the Examiner's attention is directed to the bottom right side of the Nash article submitted with the Amendment dated May 29, 2003, which indicates that the source of the Nash article is Chapter IV-Charge: Theory, Measurement, and Characterization, pages 169-180. Accordingly, the rejection should be withdrawn.

At page 6 of the Office Action, the Examiner rejects claims 1-4, 16, and 42 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., as evidenced by Ogawa et al.

(U.S. Patent No. 6,103,439) and Akiyama et al. (U.S. Patent No. 5,422,214).

The Examiner repeats her previous remarks with respect to claims 1-4, 16, and 42 in view of Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, the applicants have cancelled claims 1, 3, and 42. Furthermore, claims 2, 4, and 16 are now dependent directly or indirectly on claim 31, which is now in condition for allowance. Accordingly, the rejection should be withdrawn.

At page 9 of the Office Action, the Examiner rejects claims 5, 10, and 19 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al. and further combined with Kawasaki et al. (U.S. Patent No. 5,230,978). The Examiner repeats her previous remarks with respect to claims 5, 10, and 19 over Watanabe et al. as evidenced by Ogawa et al. and Akiyama et al. and further combined with Kawasaki et al. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claims 5, 10, and 19 are now dependent directly or indirectly on claim 31, which is now in condition for allowance. Accordingly, the rejection under 35 U.S.C. §103(a) over Watanabe et al. as evidenced by Ogawa et al. and Akiyama et al. and further combined with Kawasaki et al. should be withdrawn.

At page 11 of the Office Action, the Examiner rejects claim 6 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al. and further combined with Sukata et al. (U.S. Patent No. 5,990,332). The

Examiner repeats her previous remarks with respect to claim 6 over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al. and further combined with Sukata et al. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claim 6 is now directly dependent on claim 31, which is now in condition for allowance. Accordingly, the rejection over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al., and further combined with Sukata et al. should be withdrawn.

At page 12 of the Office Action, the Examiner rejects claim 7 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al. as evidenced by Ogawa et al. and Akiyama et al., and further combined with Akimoto et al. (U.S. Patent No. 5,707,772). The Examiner repeats her arguments from the Office Action dated January 29, 2003 with respect to rejecting claim 7 over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al. and further combined with Akimoto et al. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claim 7 is now directly dependent on claim 31, which is now in condition for allowance. Accordingly, the rejection over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al., and further combined with Akimoto et al. should be withdrawn.

At page 14 of the Office Action, the Examiner maintains the rejection of claims 8, 9, 12, 14, 17, 18, 21, 23, and 25 from the previous Office Action dated January 29, 2003 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., as evidenced by Ogawa et al.

and Akiyama et al., combined with Kawasaki et al., and further combined with Sukata et al. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, the applicants have cancelled claims 8, 12, and 21. Furthermore, claims 14, 17 and 23 are now dependent directly or indirectly on claim 31, which is now in condition for allowance. Additionally, claims 9 and 18 are now directly or indirectly dependent on claim 32, which is now in condition for allowance. Also, claim 25 is now dependent directly on claim 41, which is allowed. Accordingly, the rejection over Watanabe et al., as evidenced by Ogawa et al., Akiyama et al., combined with Kawasaki et al., and further combined with Sukata et al. should be withdrawn.

At page 15 of the Office Action, the Examiner rejects claims 11, 13, 15, 20, 22, and 24 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al., combined with Kawasaki et al. and Sukata et al. and further combined with Akimoto et al. The Examiner repeats her remarks from the previous Office Action dated January 29, 2003. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claims 11, 15, 20, and 24 are now dependent directly or indirectly on claim 31, which is now in condition for allowance. Additionally, claims 13 and 22 are now dependent on claim 33, which is now in condition for allowance. Accordingly, this rejection should be withdrawn.

At page 17 of the Office Action, the Examiner rejects claims 25-27 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al., as evidenced by Ogawa et al. and

Akiyama et al., combined with Kawasaki et al. and Sukata et al. and further combined with Saha (U.S. Patent No. 5,500,320). The Examiner repeats her remarks from the previous Office Action dated January 29, 2003 regarding claims 25-27 over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al., combined with Kawasaki et al., Sukata et al., and Saha. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claims 25-27 are now dependent directly on claim 41, which is allowed. Accordingly, this rejection should be withdrawn.

At page 18 of the Office Action, the Examiner rejects claims 28 and 29 under 35 U.S.C. §103(a) as being unpatentable over Watanabe et al. as evidenced by Ogawa et al. and Akiyama et al., combined with Kawasaki et al., Sukata et al., and Saha and further combined with Creatura (U.S. Patent No. 5,102,769). The Examiner repeats her remarks from the previous Office Action dated January 29, 2003 regarding claims 28 and 29 over Watanabe et al., as evidenced by Ogawa et al. and Akiyama et al., combined with Kawasaki et al., Sukata et al., Saha, and Creatura. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claims 28 and 29 are now dependent indirectly on claim 41, which is allowed. Accordingly, this rejection should be withdrawn.

At page 23 of the Office Action, the Examiner rejects claim 42 under 35 U.S.C. §103(a) as being unpatentable over Amering et al. (U.S. Patent No. 4,912,009) combined with Diamond, Handbook of Imaging Materials, p. 169. The Examiner repeats her remarks from the previous Office Action dated January 29, 2003 regarding claim 42 over Amering et

al. combined with Diamond. For the following reasons, this rejection is respectfully traversed.

Although the applicants do not agree with the Examiner's comments, to further expedite the prosecution of the present application, claim 42 has been cancelled. Accordingly, the rejection over Amering et al. combined with Diamond is moot.

At page 26 of the Office Action, the Examiner rejects claims 30 and 35 under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Wilson et al. '822 (U.S. Patent No. 5,922,822). According to the Examiner, Wilson et al. '822 exemplifies developers comprising toner particles and a magnetic carrier comprising copper-zinc ferrite particles coated with a polysilane. The Examiner states that according to column 20, lines 1, 2, and 12-31, and Table 7, at column 24, the toner particles comprise 4 pph of a particular charge control agent and are surface treated with DEGUSSA R972 silica. The Examiner also asserts that after mixing the toner particles with the magnetic carrier for 2 minutes, the black toner particles had a charge to mass ratio (Q/m) of -30.5 μC/g. After mixing the toner particles with the magnetic carrier for 10 minutes, the toner particles had a Q/m of -29.9 μC/g. The charge ratio of the Q/m at 2 minutes to the Q/m at 10 minutes is about 1.0, which is numerically within the range of about 0.9 to about 1.1 as recited in claim 30 of the present application.

The Examiner indicates that Wilson et al. '822 does not describe that the charge to mass ratios of its black toner particles are determined by a MECCA device as recited in the claim 30 of the present application. The Examiner states that according to the present specification at page 22, lines 1-15, the MECCA device separates the toner particles from the carrier by using two spaced-apart parallel electrode plates that apply both an electrical

and magnetic field to the developer samples and measures the accumulated charge of the collected-separated toner particles. The Examiner then states that Wilson et al. '822, at column 20, lines 35-50, describes that to determine its charge mass ratio a weighed amount of developer is placed on a mesh screen, the toner particles are removed from the carrier by passing a vacuum tube across the backside of the mesh screen, and after all the toner is removed from the carrier, the total charge is recorded. However, because the toner particles of Wilson et al. '822 meet the compositional limitations of claim 30 of the present application, and have a charge ratio of the Q/m at 2 minutes to the Q/m at 10 minutes of about 1.0, which is within the numerical range recited in claim 30 of the present application, it is reasonable to presume that the toner of Wilson et al. '822 have a 2'/10' MECCA charge ratio of from about 0.9 to about 1.1 as recited in claim 30 of the present application. For the following reasons, this rejection is respectfully traversed.

Claim 30 of the present application recites toner particles having a charged rate such that the 2'/10' MECCA charge ratio is from 0.9 to about 1.1, wherein the toner particles have at least one surface treatment agent present on the surface of the toner particles, and wherein the toner particles include a polyethylene wax or a cross-linked styrene acrylate polymer.

Wilson et al. '822 relates to polymers that are useful charge-control agents in toners and developers. The toner in Wilson et al. '822 includes a polymeric charge-control agent in an amount effective to modify and improve the properties of the toner. However, Wilson et al. does not teach or suggest that the toner particles include a polyethylene wax or a cross-linked styrene acrylate polymer. Accordingly, this rejection should be withdrawn.

At page 28 of the Office Action, the Examiner indicates that claims 40 and 41 are

allowable over the prior art of record. Furthermore, the Examiner asserts that claims 31 and 36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Similarly, the Examiner indicates that claims 32-34, and 37-39 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C.§112, second paragraph, set forth in the Office Action and to include all of the limitations of the base claim and any intervening claims. The applicants and the undersigned appreciate the Examiner's indication that these claims would be allowable. As indicated above, some of the language set forth in these claims has been incorporated into several independent claims and therefore these claims would be allowable. The applicants and the undersigned believe that in view of the above comments, the remaining claims would also be allowable.

The Examiner is respectfully requested to contact the undersigned by telephone should there be any remaining questions as to the patentability of the pending claims.

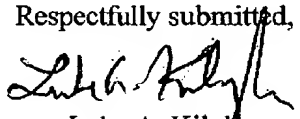
CONCLUSION

In view of the foregoing remarks, the applicants respectfully request the reconsideration of this application and the timely allowance of the pending claims.

If there are any other fees due in connection with the filing of this response, please charge the fees to Deposit Account No. 50-0925. If a fee is required for an extension of time under 37 C.F.R. §1.136 not accounted for above, such extension is requested and

should also be charged to said Deposit Account.

Respectfully submitted,



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Toner Charge Instability

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Abstract

Toner triboelectric charge can be affected by a variety of intrinsic and extrinsic factors, and production and maintenance of a stable charge requires a balancing or minimization of many complex interactions. In this review, major stability factors are discussed and illustrated using actual experimental data coupled with a simple theoretical model. Throughout, the review promotes a holistic approach in order to reinforce the view that toner charge stability is not merely a toner issue.

1. Introduction

In conventional xerography, a latent electrostatic image is developed by triboelectrically-charged toner particles, and xerographic development (to a first order) is an inverse function of toner charge level.[1] From a toner viewpoint, then, triboelectric charge—its polarity, magnitude and stability—is a critical property, and the creation and maintenance of a functional charge value is a major materials design challenge.

Since toner charge is controlled by many intrinsic and extrinsic factors, absolute charge stability is effectively an unattainable goal, and a degree of charge variability must be assumed for any commercial xerographic product. Now, in practical xerographic copiers and printers, variations in toner charge can be compensated for via closed-loop control of other factors that affect development—for example, the electrostatic image potential—but such control schemes add the expense and complexity of image density sensors, electrostatic voltage sensors, environmental temperature/RH sensors, etc.[2-5] For robust simplicity, therefore, toner charge stability remains as an important ultimate design goal.

However, besides the problems outlined thus far, there are important additional toner design limits imposed by the functional requirements of the post-development subsystems, namely the transfer, cleaning and fusing subsystems. For example, toner adhesion and flow properties affect transfer and cleaning performance, and toner rheological and surface-chemical properties are important factors for efficient fusing. As a result, optimum performance in development is frequently achieved via incorporation of external and/or internal additives (e.g., flow aids, waxes, etc.) in the overall toner design, and unfortunately these additives may also affect toner charge level and stability. Further, since toner triboelectric charge is generated via contacts with other charging surfaces—carrier beads in two-component xerography; donor roll surface and charging/metering blade or roll for single-component xerography—then the quality and stability of these non-toner surfaces must also be considered in any overall strategy for toner triboelectric charge stability.

Finally, all of the charging interactions listed thus far can also be affected by ambient environmental conditions, since triboelectric charging is especially sensitive to water vapor relative humidity.

All in all, then, triboelectric charge stability is a wide-ranging topic involving many potential complex interactions. To illustrate some of the major controlling factors for charge variability, the following discussion is based on "lessons" from experimental data, with a theoretical model for triboelectric charging being used as an overall conceptual framework.

2. Triboelectric Charging

2.1 Parametric Charging Equation

For a two-component xerographic developer, the toner charge-to-mass ratio, q/m, generated by mixing with carrier beads, can be related to the toner-to-carrier weight concentration, C, by:

$$q/m = [A_o / (C + C_o)] \cdot [1 - \exp\{-\gamma \cdot t\}] \qquad (1)$$

where A_o and C_o are characteristic parameters for any particular toner/carrier combination, t is the mixing time and γ is the effective rate constant for the charging process. Now, all of the parameters in Eq. 1 contain contributions from the controlling physics and chemistry of triboelectric charging, and the impact of these contributions on charge stability will next be discussed sequentially in the following sections, in order of increasing complexity.

2.2 Charge Generation

The second term in Eq. 1 is a simple saturating exponential function, and is a functional form typically seen when a simple, additive-free toner is mixed with carrier beads. For this process, the effective rate constant[6] is:

$$\gamma = \gamma' (C + Co) \qquad (2)$$

where γ' is a direct function of the frequency of toner/carrier mixing contacts.

Thus, for any particular mixing time, a range of q/m values can be achieved simply via an appropriate choice of mixing intensity, and this charging/mixing response is commonly seen in actual mixing experiments.[7] From a charge stability viewpoint, of course, this mixing intensity effect is a potential source of variability in q/m, and should therefore be avoided. Clearly, an effective strategy would be to set the mixing intensity at a level high enough to